



Sustainability Symposium
16th November 2018

Embedding sustainability in design education: the case of design project on systemic changes for sustainable businesses based on upcycling

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Abstract

Sustainable design education has become a prevalent practice in design education. Ramirez's (2007) worldwide survey shows that the majority of the programmes have either compulsory or optional modules on sustainable design. In particular, projects in sustainable design studio modules often deal with social or environmental sustainability issues with little attention to the practice of design for systemic changes for sustainable businesses. This paper aims to provide one such case: design project on how to scale-up sustainable businesses based on upcycling through systemic changes. A half-day student design workshop was co-planned and organised by De Montfort University and the University of Liverpool. Second-year undergraduate students in Industrial Design, University of Liverpool participated as part of Product Development 2 module. Throughout the workshop, participating students learned different approaches to sustainable design, production and consumption, challenges faced by upcycling-based businesses in the UK, and how to generate and develop ideas, concepts and system maps to resolve complex design problems involving multiple stakeholders.

Keywords: design education; scaling-up; sustainability; sustainable business; upcycling; case study; product service systems

Paper

Introduction

Sustainable design education has become a prevalent practice in design education. Ramirez's (2007) worldwide survey shows that the majority of the programmes (in leading industrial design courses from 221 schools around the world) have either compulsory or optional modules on sustainable design. In particular, projects in sustainable design studio modules often deal with social or environmental sustainability issues by design for community needs, regenerative design, inclusive design, service design, cradle-to-cradle solutions, reusable products, sustainable packaging and promotion of consumer environmental awareness (Ramirez 2007). Yet, relatively less projects to use design for systemic changes for sustainable businesses have been reported. This paper therefore aims to provide one such case: design project on how to scale-up sustainable

businesses based on upcycling through systemic changes involving multiple stakeholders. It is expected that the process and methods employed in the case can support designers to deliberately design for sustainable businesses. In addition, the identified challenges will help develop design (and education) materials that address the needs and expectations of designers in their attempts to design for sustainable businesses.

Upcycling-based businesses

Upcycling is the creation or modification of a product from used or waste materials, components or products which is of equal or higher quality or value than the compositional elements (Sung 2017, Sung, Cooper et al. 2014). It is an umbrella concept incorporating 'creative' repair, reuse, refurbishment, upgrade and much more (Sung, Cooper et al. 2018). Upcycling represents an alternative that, in theory, reduces waste (Bramston, Maycroft 2013, Zhuo, Levendis 2014), increases material efficiency and reduces industrial energy consumption, therefore contributing to lowering greenhouse gas emissions (Allwood, Ashby et al. 2011, Sung 2017). Upcycling businesses have the potential to be financially sustainable (Han, Chan et al. 2016, Teli, Valia et al. 2014) and can create jobs (Cumming 2017, Palmsköld 2015). Despite such potential economic, environmental and social benefits, upcycling remains a niche practice. A process of 'scaling-up', whereby an initially unusual practice becomes mainstream (Van den Bosch 2010), is necessary in the case of upcycling in order to contribute significantly to the environment and society.

Scaling-up niche practices

Scaling-up is often understood as the dynamic process of transitioning from niche to mainstream in transition studies (de Haan, Rotmans 2011, Smith 2007, Van den Bosch 2010). "Through scaling-up, a new or deviant constellation of structure, culture and practices attain more influence and stability and increases its share in meeting a societal need. [...] The outcomes of scaling-up are fundamental changes in the dominant way societal needs are fulfilled." (Van den Bosch 2010, p.68). Such transitions do not take place easily as the existing systems are stabilised by lock-in mechanisms relating to vested interests, sunk investments, favourable subsidies and regulations or behaviour patterns (Geels 2010, Unruh 2000). In order to overcome these lock-in mechanisms, both social changes and technological solutions are required (i.e. interrelated changes in behaviour, technology, environment, rules and regulations, financing systems and perceptions) involving various stakeholders (Geels 2004, 2010, Van den Bosch 2010).

Project background

This project was based on the collaboration between De Montfort University (Product Design, School of Design) and the University of Liverpool (Industrial Design, School of Engineering). Collaborative planning and execution were made for a design project in Product Development 2 module for second-year undergraduate students in the University of Liverpool. A project brief was created on the basis of the research undertaken on challenges and success factors for scaling-up upcycling Small- and Medium-sized Enterprises (SMEs) in the UK. The project brief outlined stakeholder interviews with material suppliers, upcycling designers and makers, retailers and consumers.

Participants and project setup

A half-day design workshop was conducted with 36 second-year Industrial Design students at the University of Liverpool in April, 2018. The workshop aimed to achieve the following learning outcomes. By the end of the workshop, students will be able to: a) discuss different approaches to sustainable design, production and consumption; b) explain challenges faced by upcycling-based businesses in the UK; and c) generate and develop ideas, concepts and system maps to

resolve complex design problems involving multiple stakeholders (scaling-up upcycling businesses in the UK) individually and as a team. For delivery, the workshop consisted of a series of activities including an introductory lecture, individual and group activities for solution ideation and development, and presentations of the workshop outcomes (see Appendix for detailed workshop schedule and procedures). The workshop was held in a studio with a cabaret setup. Students were asked to create groups of four (9 tables and 4 students per table). Papers and drawing tools were prepared for individual activities. Laptops were provided for group work (at least one per group). The workshop ended with discussion in which all groups openly discussed their learnings and lessons, and how the setup and contents could be further improved. After the workshop, the students filled out a questionnaire that assessed the contents, activities and resulting outcomes of the workshop.

Results

Students generated ideas and developed concepts in order to provide innovative design solutions for scaling-up upcycling SMEs. The solution ideas were in various forms: products, services, product service systems (PSS), policies and regulations. It was observed that students presented more service or PSS ideas than product ideas. These different forms involved different patterns of ideas in terms of their goals and design strategies. Product ideas focused on how upcycling could become part of business-as-usual or mainstream companies. Examples included premium upcycled products by collaboration between upcyclers and high-end product design companies (e.g. Bang & Olufsen), and upcycled bag and other fashion items by well-known fashion brands. Service ideas tended to focus on awareness raising targeting the general public. Examples included: a) market day for schools (e.g. showing educational videos, organising creative workshops to make upcycled products, and selling the upcycled products made by school children and parents to the local community); b) Youtube documentaries (e.g. a life of an upcycled product) made by upcycling designers, makers and companies; and c) upcycling theme park named 'Upworld' - which could have, for instance, jungle zone, log flume, virtual reality adventure, petting zoo, interactive upcycling workshop, and upcycling furniture and product shop with café at the end. PSS ideas included: a) bartering and discount system (e.g. consumers donating their clothes to fashion upcycling designers and makers get a discount for new upcycled items); b) large manufacturing companies' product take-back scheme and upcycling remanufacturing (either mass produced or bespoke); and c) website and/or mobile application provided by upcycling companies to recognise any new products (by uploaded photos) and suggest upcycled alternatives available. Policy and regulation ideas included: a) tax exemption and relief for companies specialising in upcycling products; b) tax differentiation depending on the lifetime of products, components and materials; and c) labelling system to indicate environmental impact of all mass produced and upcycled products (cf. energy efficiency rating) (Figure 1).

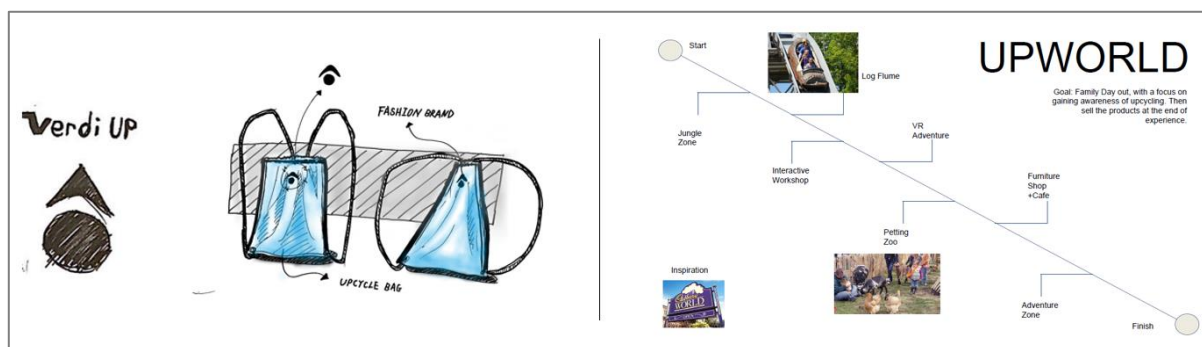


Figure 1 Concept examples

Students drew system maps to visualise how suggested solutions, stakeholders and potential outcomes were related to each other. Some of the students' system maps well reflected the complexity of the given situations and clarified resources exchanged and generated by the stakeholders whereas some did not come across as concrete and clear (Figure 2).

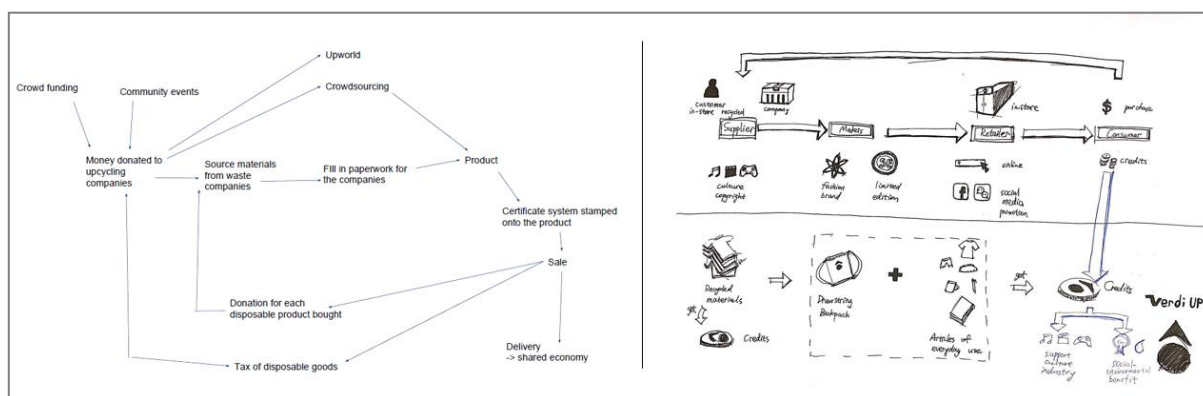


Figure 2 System map examples

Discussion and conclusion

The results of the feedback questionnaire of the workshop showed that in general, most of students learned new and different approaches to sustainable design, production and consumption, challenges faced by upcycling-based businesses in the UK, and how to generate and develop ideas, concepts and system maps to resolve complex design problems involving multiple stakeholders.

Regarding each component of the workshop, the students were most satisfied with the lecture (57%) and group idea share and system design (57%), followed by individual ideation (43%) and individual concept development (29%). They were least satisfied with group presentations (14%). When it comes to the effectiveness of delivery, the students found the group idea share and system design activity most useful to achieve the learning outcomes (72%), followed by individual idea generation (57%), lecture (43%) and individual concept development (43%). The group presentation was the least useful activity (29%). Considering difficulty of each activity, the majority of the students struggled with group presentations (57%) and individual idea generation (57%). The students perhaps felt that 30 minutes was not long enough to prepare for the presentation. The authors also witnessed that most international students spent excessive time on reading and understanding the client brief and creating a mind-map. Some students found individual concept development difficult (43%) probably because most ideas were service or system design and these students were not familiar with them. A few students found the group idea share and system design activity difficult (14%) possibly due to the newness of the concept of a system map and challenging group work.

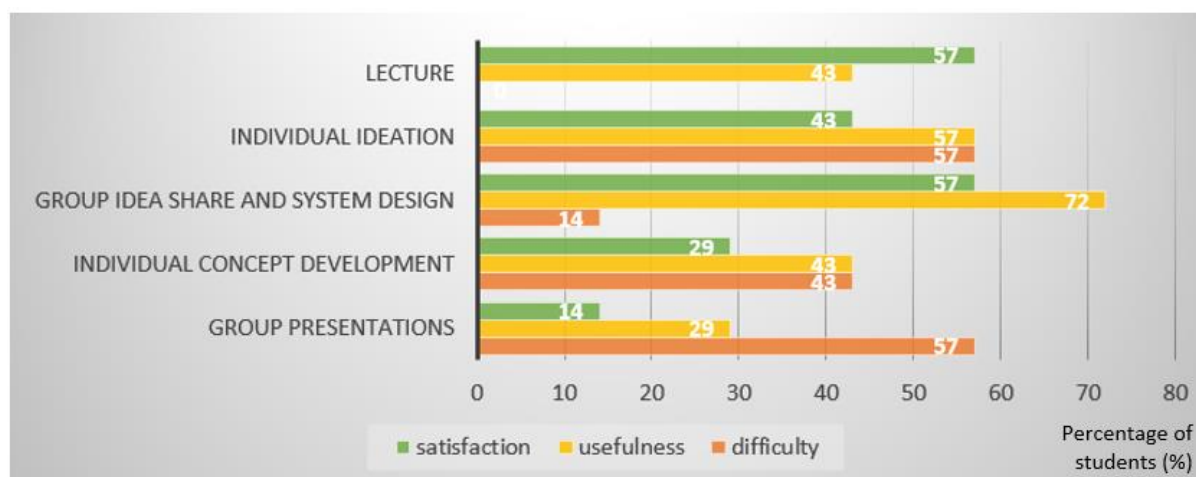


Figure 3 Satisfaction on, and usefulness and difficulty level of each workshop activity

Based on the student feedback, the following are the suggestions for those who are interested in organising a similar design workshop: a) exclude group presentations (due to low satisfaction, low perceived usefulness and high perceived difficulty); b) client/design brief distribution before the workshop (in order for students' sufficient understanding - especially international students' - and increased efficiency and effectiveness of the workshop); and c) extended lecture on service/PSS design and inclusion of a mini service/PSS design project (for those without any experience in service/system design).

Although this case study is limited (i.e. one project case with the limited number of students), this paper illustrated a good practice of embedding sustainability in design education as a form of collaborative workshop between universities. We expect that iterative applications of the workshop in various setups (e.g., in different higher education institutions and with design professionals in different business domains) will allow us to advance our understanding of how designers and design students can be supported to effectively address issues inherent in the process of designing for sustainable businesses, and improve the delivery of sustainable design education.

The paper introduced the topic of upcycling, upcycling-based businesses and the concept of scaling-up in transition studies as theoretical backgrounds of the project. It explained the situational background of the project and approaches (workshop setting, resources, schedule and procedure). It described the workshop results, discussed student feedback and made suggestions for future design workshops. We hope this paper could inspire and inform other academics in art and design so as to contribute to expanding communities of sustainable education practices.

Acknowledgements

This work was possible with the Research and Innovation Allowance from De Montfort University (DMU). The design workshop was funded by the School of Engineering of the University of Liverpool. The attendance to the Expanding Communities of Sustainable Practice 2018 Symposium was supported by the VC2020 fund from the Associate Dean for Research and Innovation in the Faculty of Arts, Design and Humanities (Deborah Cartmell). We would like to thank Stuart Lawson for supporting the research.

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Appendix. Workshop schedule and procedures

A thirty-minute lecture was delivered. The lecture included rationale behind the workshop (e.g. United Nation's Sustainable Development Goals (UN 2018)), sustainable practices (e.g. policies, regulations, waste management, corporate social responsibility activities, sustainable design, sustainable consumer behaviour/lifestyle), circular economy (Ellen MacArthur Foundation 2016), sustainable design (e.g. evolution of design for sustainability) and upcycling (Sung 2017).

Workshop schedule was introduced and each activity was explained in detail. In the first activity, four different design briefs were given to students: each group had four briefs such that each student had a distinct one. Each brief described a client profile, problems and issues with direct quotes from the stakeholder interviews and the client's goal (Figure 4). Students were asked to read the brief thoroughly and carefully and create an individual mind-map for their own comprehension. They were then asked to generate a minimum of ten ideas (rough sketches and annotations) per person.

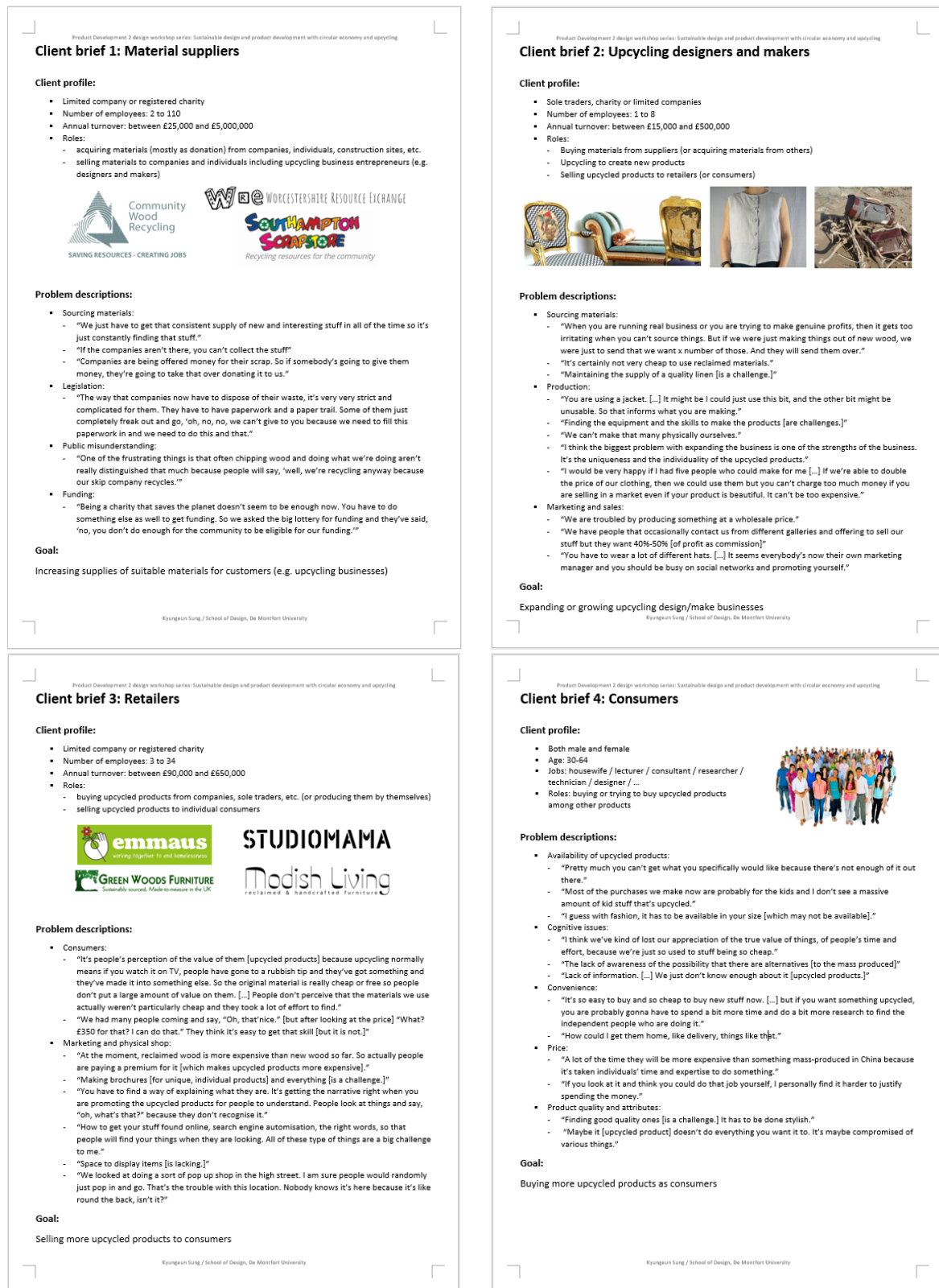


Figure 4 Four design/client briefs based on the stakeholder interviews

In the second activity, students were asked to share their brief and ideas in a group and select top three ideas per person based on group discussion or voting. As a group, students were asked to create a system map¹ (Van Halen, Vezzoli et al. 2005) to visualise all stakeholders and all selected

ideas, showing interrelationships, connections and flows between stakeholders, infrastructure, products, services, activities and information. Examples of system maps were provided as handouts (Figure 5).

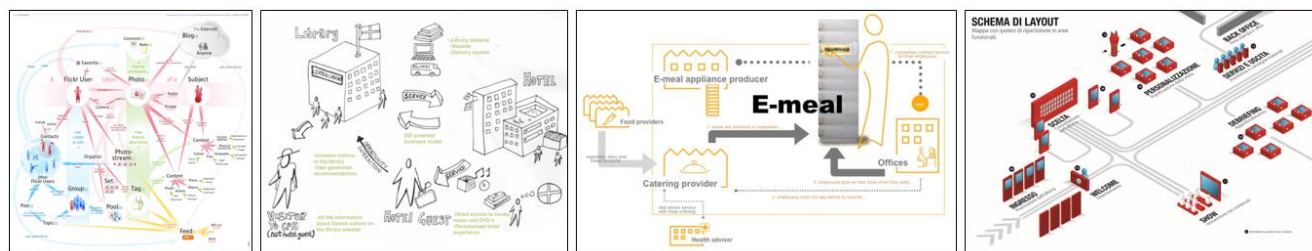


Figure 5 System map examples from <http://www.servicedesigntools.org/tools/28>

In the third activity, students were asked to create a minimum of three variations of each selected idea and develop a minimum of three ideas into concepts. Students were then asked to prepare for a five-minute PowerPoint presentation including mind-maps, selected ideas, fully developed concepts, system map and what they have learned throughout the workshop. Each group presented the workshop results. At the end of the workshop, a feedback questionnaire was shared with the students. See below the table for the workshop schedule and summary of activities and outcomes.

No.	Time	Duration	Activity	Outcome
01	09:00-09:30	30 mins	- Presentation on sustainable design, product development and upcycling - Q&A	-
02	09:30-09:50	20 mins	- Presentation on workshop schedule and activities - Q&A	-
03	09:50-10:20	30 mins	- Design brief comprehension - Individual idea generation	A minimum of 10 ideas per person
04	10:20-10:30	10 mins	Break	
05	10:30-11:00	30 mins	Group idea share and system design	One system map per group (including a minimum of 3 selected ideas per person)
06	11:00-11:30	30 mins	Individual idea development	A minimum of 3 variations per selected idea and a minimum of 3 (ideally fully) developed concepts
07	11:30-12:00	30 mins	Group presentation preparation	A group presentation ppt/pdf including one system map and a minimum of 3 concepts per person
08	12:00-12:30	30 mins	Lunch break	-
09	12:30-13:15	45 mins	Group presentation	5-minute presentation per group
10	13:15-13:45	30 mins	Feedback questionnaire	-

1. A system map supports the visualisation of stakeholders of product service systems, and facilitates material, information, and financial flow among them. It visualises the importance of flow and highlights which stakeholders are involved and how they interact to support a specific action of a stakeholder (Van Halen, Vezzoli et al. 2005).

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